said that if Mr. Solly's paper were sent in it should receive careful consideration.

NOTWITHSTANDING the vast importance of St. Paul's Cathedral and the impossibility of making up for its loss were it destroyed, until recently it was in imminent danger of being shattered by every thunderstorm that passed over it. The lightning-rods that were supplied to it 120 years ago have long been utterly useless, and from its position, size, and certain peculiarities of structure, the noble building formed a tempting object of attraction to the destructive stroke of lightning. Happily, we learn from the *Telegraphic Journal*, this is no longer the case. The authorities, dissatisfied with the electrical state of the building, upon the report of Mr. John Faulkner, Associate of the Society of Telegraph Engineers, of Manchester, commissioned him to prepare a plan for the fitting of the cathedral with an efficient system of conductors. The plan submitted was approved, and the fitting is now completed. In metallic connection with cross and ball and scrolls are eight copper conductors, each being a ½-inch strand of copper wires. The octagonal strand has been adopted as giving most metal in the least space. These eight conductors then pass to the metallic railing of the Golden Gallery, with which they are in metallic connection. Thence they are carried down to the dome, to the metallic surface of which they are again connected at several portions of their length. Then down the rain-falls, over the leaden roofs of the aisles, in the angles formed by the aisles themselves, again down the rain-falls to the sewers. Further, the choir and nave roofs are connected together by a saddle or conductor stretching over them both, and joined to the conductors proceeding from the summit of the west towers. Even this did not satisfy the zealous care of Mr. Faulkner, who tested, sheet by sheet, the electrical condition of the leads, connecting the worse insulated sheets by copper bands to the better conducting surfaces. Thus the dome, aisle-roofs, and ball and cross, and the two west towers, form one immense metallic conductor, and the danger arising from interior gas-piping is removed; for Coulomb and Faraday have proved beyond doubt that electricity accumulates upon the surface only of bodies. In the sewers, which always afford a moist earth connection, the copper strands are riveted to copper plates, and these again are pegged into the earth. By this means as good an earth connection is obtained at the top of the cross, at the very summit of the Cathedral, as is found in the sewers at its base.

THE Examinations in the Crystal Palace School of Practical Engineering, for the Easter term, commenced last Saturday, and will close on Friday, August 9th. The Autumn Term will commence on Monday, September 8. The Principal will attend in the school from 10 till 4 each day, from Saturday, August 2nd, to Friday, the 8th, to pass Candidates for admission.

AN earthquake occurred at Jamaica at 0·30 A.M. on July 1, which created much alarm. It lasted nearly five seconds.

AMONG Mr. Murray's announcements of forthcoming works are—"Personal Recollections, from Early Life to Old Age," by Mary Somerville; "The Geography of India, Ancient and Modern," by Colonel Yule, C.B.; "The Naturalist in Nicaragua," by Thomas Belt, F.G.S.; and a popular edition of Mr. H. W. Bates's "The River Amazons."

A NEW and cheap edition of Mr. James B. Jordan's "Elementary Crystallography" has been published by Mr. Murby as one of his series of science manuals. To any one commencing the study of crystallography this manual will be very useful, especially as appended to the letterpress is a series of carefully drawn nets for the construction of models illustrative of the simple crystalline forms.

THE report of the annual meeting of the Perthshire Society of Natural Science shows that Society to be in a prosperous and good working condition. The number of members is large, and among them is a fair proportion of workers. We are glad to see that excursions have been started, and hope they will be continued; no richer field, we are sure, than the County of Perth, especially for Botany, exists in this country. The Society, under the energetic management of Dr. Buchanan White, of Dunkeld, is publishing a Fauna and Flora of Perthshire, and it is under its auspices the *Scottish Naturalist* is brought out. During the last summer Mr. J. Allen Harper turned out, for the purpose of acclimatisation, about 7,000 living specimens of the following molluscs: *Helix virgata*, *H. pisana*, and *Bulimus acutus*. The annual address of the president, Col. Drummond Hay, occupies the greater part of the report, and gives many interesting details concerning the birds of Perthshile. The Society has entered on the seventh year of its existence.

THE following are the chief additions to the Brighton Aquarium during the past week:—4 Corkwing Wrasse (*Crenilabrus melops*); 7 Pogge (*Agonus cataphractus*); 1,000 Prawns (*Palæmon serratus*); several groups of *Serpula contortuplicata* and *Alcyonium digitatum*. Four young rough-hounds (*Scyllium canicula*) have been hatched from eggs laid during the last week in January. The period of their development in *ovo* is therefore six months. A large number of young Squid (*Loligo vulgaris*) have also been hatched from spawn brought in by fishermen.

THE additions to the Zoological Society's Gardens during the last week include an Ocelot (*Felis pardalis*) from America, presented by Mr. A. B. Keymer and Mr. C. C. Lovesy; a Togue Monkey (*Macacus pileatus*) from Ceylon, presented by the Sergeants of the 1st Batt. Scots Fusiliers; a grey Ichneumon (*Herpestes griseus*) from India, presented by Mr. G. S. Daintry; a starred Tortoise (*Testudo stellata*) from India, presented by Capt. C. S. Sturt; two lesser black-backed Gulls (*Larus fuscus*), presented by Mr. C. W. Wood; two crested Pigeons (*Ocyphaps lophotes*), hatched in the Gardens; a Hoffmann's Sloth (*Cholopus hoffmanni*) from Panama, and a black-eared Marmoset (*Hepale jacchus*) deposited.

METEOROLOGY IN HAVANNA [*]

TO judge from the pamphlets mentioned below, the practical study of Meteorology seems to be pursued at the Cuba Observatory with diligence and a harvest of good results. The care and skill with which they are compiled must lead to the conclusion that science will receive very valuable aid both in meteorological and magnetic research from this station of the West Indies.

The observatory is situated at a height of 19·297 metres above the sea level, in N. lat. 23° 8′ 14″·5, its longitude being 76° 9′ 42″·8 west of San Fernando, and therefore 82° 22′ 6·95 west of Greenwich. The first volume is a yearly meteorological and magnetic report, and consists entirely of monthly tables and curves of the daily mean results of the barometer, thermometer, tension, humidity, wind, evaporation, rain, and state of sky. For each month the daily maximum, minimum, and mean values are given, and then follows a table of the monthly means for every even-hour of the day and night. The direction and force of the wind are shown on a circular diagram, and the mean daily values of the barometer, thermometer, tension, and humidity are exhibited by broken lines. Rain curves are added from May.

Regular two-hourly observations of the Magnetic Declination were commenced on April 1, 1871, and the same details are given as for the barometer, &c. To these were added at the commencement of the following month similar observations of the horizontal magnetic force. For these elements of terrestrial magnetism two-hourly, as well as daily mean, curves are traced for each month.

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[*] Observaciones Magneticas y Meteorologicas del real Colegio de Belen de la compania de Jesus en la Habana, de 30 Nov. 1870 a 30 Nov. 1871.

Memoria de la Marcha regular o periodica, et irregular, del Barometro en la Habana des de 1853 à 1871 inclusive, por el R. P. B. Vines, S.J.

Observaciones correspondientes al mes de Octubre de 1870, con la descripcion de los huracanes ocurridos en la Isla en dicho mes.

In the general table that closes the report, we notice that the prevailing wind never deviates, in any season, more than 13° 31′ from the east, and in spring it is only 3° 36′ N. of E. The rainfall for the seasons given in millimetres was in winter, 71·1; in spring, 181·0; in summer, 480·0; and in autumn, 547·2; the number of rainy days being respectively 13, 15, 33, and 39.

The coincidence of magnetic disturbances with local storms, with hurricanes in Florida and St. Thomas, with Auroras visible in distant lands, and with similar magnetic perturbations in England, was remarked in August, September, and November. The frequent disturbances of the needle noted in October certainly do not agree with photograghic records in England, this month having been remarkably free from perturbations of this nature.

The second book contains the results of a continued series of barometric observations between the years 1858 and 1871. The reliance we may place on the accuracy of the work can be estimated from the fact, that the correction of 1·07mm. for sea level was the result of 2,000 comparisons.

A very regular double period is apparent in the daily range, which may be represented by the expression $h = k \sin (a + t) + k' \sin (b + 2t)$; but the range for the day hours is somewhat in excess of that of the night. The minima occur at 2—4 A.M. and 3—4 P.M., and the maxima at 9—10 A.M. and 10 P.M., the times varying slightly with the seasons.

In December, January, and February, the amplitude of the daily range is greatest, and then gradually decreasing it attains its minimum in June and July. This confirms the law of Ramond, cited by Kaemtz, that the amplitude of the barometric range within the tropics is least in the rainy season. This annual variation of the daily range is, remarks our author, the more worthy of note, as it is directly opposed to what has been observed in Europe, where the range is greatest in summer. This remark appears to me to require some modification, for on turning to the monthly mean range observed, for instance, at Stonyhurst, during the last quarter of a century, I find a perfect agreement with the annual variation for Cuba. The mean values for the several months at Stonyhurst are 1·448, 1·415, 1·378, 1·167, 0·970, 0·896, 0·869, 0·927, 1·217, 1·323, 1·451, 1·449. These means are, it is true, obtained from the extreme monthly maxima and minima, but our author informs us that the amplitude of the extraordinary oscillations, if we eliminate the four greatest which were due to hurricanes, resembles the mean annual variation of the range, being greatest in January and least in July. The mean values of the extraordinary oscillations being almost identical in November, December, February, and March, give this annual daily range curve at Cuba a singular symmetry. The periodic recurrence of summer storms at fixed hours will account for the diminution of the range in that season.

The mean values of the Daily Range have been deduced by several methods: 1. From the absolute maxima and minima, by which the irregular oscillations are not sufficiently eliminated. 2. By Humboldt's method, from the maxima and minima at fixed hours. 3. By Kaemtz's method, from the arithmetical means of the maxima and minima. 4. From Bravais formula, $R = \sqrt{\frac{d^2 + d_2^2 + .. d_n^2}{n}}$; d, d_2 . . . being the differences between the monthly mean and those of certain fixed hours. There is a striking agreement in the results from all these methods, but the second shows in certain cases signs of a suspicious irregularity.

Besides the Daily Range, and an annual variation of this range, there exists a yearly variation of the mean value analogous to the diurnal, having its principal maximum and minimum in January and October, and secondary ones in July and May. This double inflexion of the mean annual curve is peculiar to Cuba, since there is generally in the same latitude only a single maximum in January, and a minimum in July.

The abnormal inflexion occurs during the month of June, July, August, and September. Kaemtz, in his "Méteorologie," who is followed by Marie Davy, fixed the principal minimum in August, but this and other lesser differences arise probably from not eliminating extraordinary perturbations, and from the confessed imperfection of his series of observations.

The observations of fourteen years are insufficient to determine any certain law respecting the years of hurricanes; but an inspection of the yearly curves shows that 1865 and 1870 are distinguished from the rest by the almost identity of the means for February, March, and April, followed by a rapid rise from May to July, a fall from July to October, and a still more marked rise from October to January.

The third pamphlet gives a very interesting and detailed account of the terrible hurricanes that caused such wide-spread desolation in the October of 1870. The first storm occurred on the 7th and 8th, the second on the 19th and 20th.

The author adopts the theory of cyclones first enunciated by Redfield in 1831, and since accepted and modified by many eminent meteorologists. Situated N. of the Equator he considers the storm to be rotating in the direction from E. to W. through N. and the centre to be at the same time moving N.W. within the tropics, and N.E. in higher latitudes. The resultant path he finds to be a spiral wrapped round a parabola, the folds of the spiral being closest at the apex of the curve. The position of the centre or vortex is given at any moment by the height of the barometer and the direction of the wind. The barometer being lowest at the centre, the reading of the mercurial column, corrected for daily range and for the particular wind, furnishes data for determining the distance of the centre, whilst the angular bearing of the latter is known from its being at right angles to the direction of the wind, and to the rigtht hand of an observer facing the wind. This follows necessarily from the circular motion of the cyclone, and falls, as a particular case, under the general law of Buys Ballot, since we know that the barometer is lowest at the vortex. The latter is thought to move in a cycloidal curve with loops at the cusps, which just fall on the parabolic trajectory. The vortex is thus almost always to the E. of the parabola. The double motion of translation and rotation causes the effects of the hurricane to be much more disastrous in the N. hemisphere to the E. of the parabolic path than on the W. side, and the velocity of the wind at a given distance from the vortex for any points of the compass may be found from the formula $V = \sqrt{t^2 + r^2 + 2tr \cos \theta}$, where t and r are the velocities of translation and rotation, and θ is measured from the E. point when the storm is moving N. The calm at the centre of the cyclone gives a ready means of estimating the velocity of translation. The storm of the 7th was felt from the 4th to the 13th, the maximum humidity lasting till the 12th. The rate at which the vortex crossed the island was only four miles an hour, and this remained almost constant throughout. The second storm was much more sudden and rapid, and the increasing rate, from 9½ to 20 miles an hour, at which the vortex was travelling, showed that the second branch of the parabola had been reached before passing Cuba.

Equal heights of the barometer combined with the directions of the wind enable the meteorologist to lay down the parabolic trajectory with considerable accuracy, either from observations at a single station, or at several. Thus on the 7th at 2 P.M. the corrected barometer read the same at Havannah and at Cienfuegos, the wind being S. by W. at the latter, and N.E. at the former station, the vortex was therefore at that time S.E. of Havannah, and a few degrees N. of W. from Cienfuegos, but equally distant from the two places. The more rapid changes and greater fall of the barometer, together with the increase in the velocity of the wind, show that the storm passed more centrally over Havannah than over Cienfuegos. The discharges of electric fluid were very intense, and at Cardenas an appearance similar to the aurora borealis was visible for ten minutes. The magnetic needles were much disturbed. The inundations from the rising of the sea were very destructive, and on the 7th the existing wind favoured the rise. This rise under the centre of the cyclone seems to follow from the removal of pressure, and the inrush of air of different temperatures fully accounts for the heavy rainfall. The diminution of atmospheric pressure is also offered as a probable explanation of the slight shocks of earthquake, due perhaps to the violent expansion of certain gases confined within the cavities that abound in the island.

A careful consideration of the accounts published in the local papers, and a personal inspection of the localities, tended strongly to confirm the results of theory.

Cuba, from its situation just within the Tropic of Cancer, and at the entrance to the Gulf of Mexico, is admirably placed for the study of these cyclonic storms, and eight of those which have been best observed are traced on a map appended to the pamphlet, showing that in most cases the apex of the parabolic curve is not far from the island. It is a subject of congratulation that an observatory so well conducted, and so situated, has, by the kind assistance of Sir E. Sabine, been provided with a set of magnetic instruments by which the connection of terrestrial magnetism with the most violent of our tropical storms may be thoroughly investigated.

SCIENTIFIC SERIALS

THE *Monthly Microscopical Journal* for this month commences with a paper by Mr. W. H. Dallinger and Dr. Drysdale, entitled "Researches on the Life History of a Cercomonad: a lesson in Biogenesis,"—in which they describe, as the result of a very thorough and long-continued series of observations, the life history of a new Cercomonad, which is thus summarised:—"When mature, it multiplies by fission for a period extending over from two to eight days. It then becomes peculiarly amœboid; two individuals coalesce, slowly increase in size, and become a tightly distended cyst. The cyst bursts, and incalculable hosts of immeasurably small sporules are poured out, as if in a viscid fluid, and densely packed; these are scattered, slowly enlarge, acquire flagella, become active, attain rapidly the parent form, and once more increase by fission." They show also that the granules can withstand a temperature much higher than can the mature forms.—Dr. Royston-Pigott makes remarks on the Confirmation given by Dr. Colonel Woodward to the "Colour test," which comes into play in proving that spherical aberration is reduced to a minimum in objectives.—Dr. Dawson remarks on Mr. Carruthers' views of Protataxites, the latter author having described it as a gigantic seaweed, called by him *Nematophycus*. Dr. Dawson gives further reasons for maintaining his original opinion that it is phænogamous.—Prof. Rupert Jones continues his excellent papers on Ancient Water-flees of the Ostracodous and Phyllopodous tribes (Bivalve Entomostraca). This is followed by an article on the pathological relations of the diphtheritic membrane and the croupous cast, by Mr. Jabez Hogg, which would have been more in place in a medical journal. The Wenham-Toller controversy is maintained by the latter and some others, and there are abstracts of several interesting papers, with notices of Vol. III. of Stricker's Histological Manual and Dr. Frey's work on the microscope.

Foggendorff's Annalen der Physik und Chemie: No. 4, 1873.—In this number appears the sixth of the series of papers on internal friction of gases, by O. E. Meyer and F. Springmühl. The authors, having formerly examined the transpiration of atmospheric air through capillary tubes, have further observed that of carbonic acid, of oxygen, and of hydrogen, and find the Poiseuille law to hold good for these gases also. In most of the experiments the gas streamed from one vessel into another containing the same gas at lower pressure; but the case of a gas streaming into a vessel containing another kind of gas was also examined. The velocity of transpiration proved the same, and there was no counter-current of the second gas through the capillary tube, as in the case of diffusion. In an appended note the authors criticise some experiments of von Lang.—Dr. Röntgen gives details of a careful determination of the relation of specific heat at constant pressure to that at constant volume, for the gases, air, carbonic acid, and hydrogen; the mean numbers obtained being 1·4053, 1·3052, and 1·3852 respectively. The writer discusses these results in their bearing on the mechanical equivalent of heat, and the velocity of sound, and compares the work of previous experimenters on the subject.—The concluding part of a paper by F. Rudorff on solubility of salt mixtures appears in this number; and A. Potier replies to certain strictures, by Quincke, on some recent observations of his, as to reflection from metals and glass. Among the remaining matter may be noted an important memoir by G. Rose (communicated to the Berlin Academy), on the behaviour of the diamond and graphite on being heated. The author describes and illustrates the regular forms produced in the diamond through combustion, treats of the general heating effects where air is excluded and where it is not, the natural blackening of diamonds, the so-called carbonate, and connected topics.—A note by F. Zöllner, detailing further experiments to show that electrical currents are produced by current water (a statement which was questioned by Beetz a short time since), also deserves attention.

Der Naturforscher, June 1873.—Among the more important papers in this issue we may note the account of Pettenkoler and Voit's recent researches on the value of fat as a nutritive substance. They find that fat is very largely absorbed from the alimentary canal, but after long feeding with great quantities of fat the absorption becomes less; also that (contrary to a common opinion), fat is much more readily decomposed into simpler products than albumen. The decomposition of food-fat depends on that of albumen, on the amount of albumen present, and on the proportion of it fixed in the organs, to what is in circulation. The results given in this memoir have an important practical bearing. Another physiological paper treats of the influence of food on the structure of digestive organs: the experimenter, H. Crampe, thinks that the nature of food, alone, affords no sufficient explanation of the differences found in these.—An article on the loss of free nitrogen in putrefaction describes some interesting experiments by Messrs. König and Kiesow. In physics and chemistry we find notes on the change of length and electricity produced by the galvanic battery, on the action of electricity on carbon compounds, on Dr. Gladstone's new air battery, on the action of electrical force on non-conductors, &c.—There are two French astronomical papers, one on an attempt to measure the diameter of Sirius; the other, on MM. Cornu and Baille's new determination of the mean density of the earth. Geology, meteorology, and other branches of science, are also represented.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, July 28.—M. de Quatrefages, president, in the chair.—The following papers were read:—On the exponential function, by M. Hermite.—An examination of the theory of the thrust of earthworks against their sustaining walls, by M. de Saint-Venant. This was a criticism on M. Curie's late papers on this subject.—On a proposed regular service of train transports between Dover and Calais, by M. Dupuy de Lôme. The author, in conjunction with Mr. Scott Russell, has devised a method of transporting entire trains by means of large steamers. Part of the paper was devoted to a project of a new port west of Calais, as that place is useless for the purpose; at Dover everything is ready for such a purpose, there being now 40 ft. of water at the end of the Admiralty pier at low tide. The proposed scheme would be able to carry 800,000 passengers, and 870,000 tons of goods annually.—On electric cauterisation applied to surgery, by M. Sédillot.—New researches on the solar diameter, by Father Secchi. The author had found the sun's diameter, observed spectroscopically in the lines C and B, to be less than that given by the Nautical Almanac; he hence advocated the use of monochromatic images for making such determinations, and replied to some objections of S. Respighi, who, on repeating these experiments, agreed with the almanac.—M. Ledieu's paper on thermo-dynamics was continued.—On a new method of condensing liquefiable bodies held in suspension in gases, by MM. Pelouze and Audouin.—On different forms of curves of the fourth order, by M. H. G. Zeuthen.—On the respiration of submerged aquatic vegetables, by MM. P. Schutzenberger and F. Quinquaud.—On the structure of the cerebral ganglia of *Zonites algirus*, by M. H. Sicard.—On the planet Mars, by M. C. Flammarion.—On a new system of pneumatic telegraphy, by MM. D. Tommasi and R. F. Michel.

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